

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.:

Group Art Unit:

Inventors: Arman et al.

Filed: Concurrently

Title: Superconducting Magnet System With  
Supplementary Heat Pipe Refrigeration

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Sir:

In accordance with 37 CFR 1.51, 1.56 and 1.97 to 1.99, the following is a relevance statement on each citation listed on attached form PTO-1449, and is made of record to assist the Patent & Trademark Office in its examination of this application:

U.S. 4,680,936 – Sarwinski et al. discloses a cryogenic magnet system for use in MRI devices comprising an electromagnet immersed in a first tank located in an evacuated container and a refrigerating system external to the evacuated container which includes a gas and means for liquefying the gas. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

U.S. 4,782,671 – Breneman et al. discloses an MRI magnet system wherein the magnet is housed in a vacuum vessel and a cryogenic refrigerator is supported by the vacuum vessel and extends inside. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

U.S. 4,924,198 – Laskaris discloses a superconductive magnet for magnetic resonance imaging positioned within a housing with a multiple stage cryocooler mounted in the housing with one stage of the cryocooler thermally coupled to a radiation shield and with another stage thermally coupled to heat conductive means. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

U.S. 6,374,617 – Bonaquist et al. discloses a pulse tube system wherein a product fluid such as hydrogen is preferably precooled and then liquefied, subcooled and/or densified by heat exchange with ultra cold gas generated by a pulsing compression wave which rejects heat into a cryogen fluid heat sink. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

U.S. 6,640,553 – Kotsubo et al. discloses a pulse tube refrigeration system having a pulse generator, a regenerator and a pulse tube, comprising a tapered work transfer tube interposed between the pulse generator and the regenerator. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

U.S. 6,544,038 – Acharya et al. discloses a pulse tube refrigeration system wherein the pulse tube working gas is cooled to a defined first stage temperature and is brought to a defined second state temperature by operation of a regenerator and pulse tube, which are in flow communication through a cold heat exchanger, prior to providing

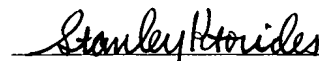
refrigeration to a high temperature superconduction. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

Advanced Cryocooler Cooling For MRI Systems – Ackermann et al. describes the impact that certain cryocooler developments have had on MRI systems. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

Cryogenic Refrigerator Evaluation For Medical And Rotating Machine Applications – Ackermann et al. describes an evaluation performed after an apparent failure of a large number of refurbished cryocoolers. There is no disclosure of a superconducting magnet system wherein a cryocooler provides refrigeration to a cryogenic shield for the superconducting magnet and a heat pipe extends from the cryogenic shield to a cryogen vessel for the provision of supplementary refrigeration, and thus this reference neither discloses nor suggests applicants' claimed invention.

A copy of each of the non-patent citations is enclosed herewith.

Respectfully submitted,



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Serial No.

### Information Disclosure Citation

(Use several sheets if necessary)

Applicants  
Arman et al.

Filing Date

Group

#### U.S. PATENT DOCUMENTS

Examiner Initial	Document Number								Date	Name	Class	Subclass	Filing Date if Appropriate
	4	6	8	0	9	3	6	7/1987	Sarwinski et al.	62	45		
	4	7	8	2	6	7	1	11/1988	Breneman et al.	62	514		
	4	9	2	4	1	9	8	5/1990	Laskaris	335	216		
	6	3	7	4	6	1	7	4/2002	Bonaquist et al.	62	6		
	6	6	4	0	5	5	3	11/2003	Kotsubo et al.	62	6		11-20-02
	6	6	4	4	0	3	8	11/2003	Acharya et al.	62	6		11-22-02

#### FOREIGN PATENT DOCUMENTS

	Document Number								Date	Country	Class	Subclass	Translation	
													Yes	No

#### Other Documents (including Author, Title, Date, Pertinent Pages, Etc.)

			Ackermann et al., "Advanced Cryocooler Cooling for MRI Systems", Cryocoolers 10 (1999) pp 857-867
			Ackermann et al., "Cryogenic Refrigerator Evaluation for Medical and Rotating Machine Applications", Cryocoolers 12 (2003) pp 805-811

Examiner

Date Considered

\* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.